with Lummer-Gehrcke plates, are cited for the sake of comparison :—

λ = 5790 (*Yellow line*).

Observed δλ	Intensity	Janicki	Baeyer
−0·266	1/9	−0·251	—
−0·170	1/10	−0·187	−0·19
−0·122	1/4	−0·119	−0·127
−0·077*	1/7	—	—
−0·032*	1/9	—	—
Principal Line		Principal Line	Principal Line
+0·035*	1/4	—	—
+0·073	1/8	+0·084	—
+0·142	1/8	+0·132	+0·139
+0·189	1/6	+0·168	—
+0·235	1/4	+0·230	+0·237

λ = 5461 (*Green line*).

Observed δλ	Intensity	Janicki	Baeyer
−0·247	1/3	−0·232	−0·250
−0·216*	1/8	—	—
−0·175*	1/9	—	—
−0·142*	1/8	—	—
−0·110	1/4	−0·099	−0·107
−0·084	1/2	—	−0·072
−0·058	1/4	−0·066	−0·051
−0·024	1/2	—	−0·025
Principal Line		Principal Line	Principal Line
+0·033*	1/7	—	—
+0·068*	1/3	+0·088	+0·087
+0·109*	1/4	—	—
+0·143	1/8	+0·133	+0·132
+0·201*	1/8	—	—
+0·230	1/7	—	+0·222

Some of the lines not observed by Janicki and Baeyer, and marked with an asterisk, seem to be new, but the scanty literature on spectroscopy at my disposal does not permit me to conclude which of them were observed for the first time.

Of the numerous satellites of the green line, −0·232, observed by Janicki, is separated into two lines, −0·247 and −0·216, and −0·099 into two, −0·110 and −0·084. The lines −0·216 and +0·033 are evidently the same as −0·208 and +0·032 given by Gray and Stewart. The satellite +0·087 observed by Baeyer, +0·088 by Janicki, +0·093 by Gehrcke and Baeyer, +0·082 by Fabry and Perot, and +0·084 by Houston is resolved into two components of nearly equal intensity, +0·068 and +0·109. Gray and Stewart give only +0·067. The green line was separated into twenty-one components by Lummer and Gehrcke with a single interference plate; here it is separated into fifteen lines. Some of these lines will be separated into components by increasing the resolving power.

The spectrum produced by heating an ordinary vacuum tube of **H**-shape containing a few drops of mercury, and excited by an induction coil, gave results almost coinciding with those of Janicki, as observed by Mr. Amano and myself. The appearance of the satellites seems to be influenced greatly by the construction of the tube and the mode of excitement.

H. Nagaoka.

Physical Institute, Tokyo University, March 15.

Mendelian Characters among Shorthorns.

I was much interested in Prof. James Wilson's letter in Nature of April 2, and I sent the number to my friend, Mr. William Duthie, of Collynie, Tarves, Aberdeenshire, a well-known breeder of Shorthorns of the first class, in the hope that Mr. Duthie, from his own experience, might check some of the numbers given by Prof. Wilson. Mr. Duthie sent my note to Dr. Thomas F. Jamieson, of Ellon, who is also a famous breeder of Shorthorns, as well as an agricultural chemist of repute. Dr. Jamieson wrote to Mr. Duthie, and I have the authority of both to send the following extract from his letter, which will interest, not only Prof. Wilson, but also those who may be collecting statistics regarding the Mendelian aspects of the problem of heredity :—

"I have long been of opinion that the Shorthorns have arisen from a combination of a red breed and a white one. There is a remarkable tendency in them to produce animals which are *entirely* white (unless, perhaps, the ears), more so, I think, than those which are entirely red, and I find that of the white calves the majority are females. I would like you to test this latter point from your own knowledge, in order to see if you also find it so. There is no doubt that a red bull mated with a red cow will almost always produce a red calf, more especially if the bull's own parents were both red, and similarly with white upon white. My red bull "Topsman," 63,447, gave me 113 calves, and not one of them white. He was mated eleven times with a white cow, and the result was ten roans and one red. He was mated sixty times with a red or red-and-white cow, and *every one* of the calves was red. He was mated forty-two times with a roan cow, with the result that twenty-three of the calves were roan and nineteen red. "Topsman" had white socks on the hind shanks, and several of his calves had so too, probably about twenty-six of them, or 23 per cent."

John G. McKendrick.

Maxieburn, Stonehaven, April 11.

Ionisation of Air by Ultra-violet Light.

Since Lenard has shown that ionisation of the air is produced by light of short wave-length, it has seemed advisable to extend his researches into the region of the extreme ultra-violet, discovered by Schumann, and to investigate the effect on air of light of wave-length below λ 1850.

For this purpose, a discharge tube filled with hydrogen to a pressure of 1 mm. of mercury, and a screen-cell, were used, both similar to those described by Prof. Lyman in the *Astrophysical Journal*, March. Below the screen-cell was a chamber where ionisation took place. Dry, dust-free air was blown through this chamber into a cylindrical condenser system. The ionisation produced by the light from the vacuum tube was measured by the charge acquired by one of the cylinders, the other being kept at a constant potential. The air pressure in the screen-cell could be varied at will. Precautions were taken to guard against surface effects.

Under these conditions, it has been found that the ionisation increases in a most marked degree as the pressure in the screen-cell is decreased. It is, therefore, evident that ionisation is produced in air by light from that part of the spectrum discovered by Schumann, and that the effect increases considerably with decrease in wave-length, at all events, in the neighbourhood of λ 1800.

It is proposed to investigate the effect in some of the elementary gases.

Frederic Palmer, jun.

Haverford College, Haverford, Pa., U.S.A.,
April 10.

THE INTERNATIONAL MATHEMATICAL CONGRESS AT ROME.

The congress of 1908 has been considerably larger than its three predecessors. Up to April 4, the official membership list contained 648 names, but later additions have increased the number of those present to about 530 members, and 167 ladies accompanying them. The weather has been of the same unsettled character that we are accustomed to describe as "British Association weather," but the brilliancy of the gatherings has not been materially affected by the spells of rain.

The proceedings commenced with a reception at the University, given by the rector (Prof. Tonelli) on Sunday, April 5, but the congress was formally opened on the following morning in the Hall of the Horatii and Curiatii at the Capitol, in the presence of the King, when addresses were read by Mr. Nathan, Mayor of Rome, by Prof. Blaserna, representing the Reale Accademia dei Lincei, and by the Minister of Public Instruction.

A discourse was afterwards read by Prof. Vito Volterra on mathematical progress in Italy during the last half of the nineteenth century. Prof. Volterra discussed the work of Cremona, Betti, Brioschi, Beltrami, Fergola, Battaglini, and Dini, and directed attention to the recent publication of Galileo's complete works under the patronage of the King.

The subsequent meetings were held in the magnificent suite of rooms occupied by the Reale Accademia dei Lincei at the Palazzo Corsini, where ample accommodation was available for general and sectional meetings, as well as secretarial and post offices and a buffet. The pretty garden behind the palace was also thrown open, and in the groves the wild *Bellevallia romana* was in full flower. A service of automobiles running intermittently to and from the middle of the town was placed at the disposal of the members. At the first general meeting a report was presented by Profs. Segre, Noether and Poincaré, awarding the Guccia medal to Prof. Francesco Severi for his work on geometry of algebraic surfaces. Subsequently Prof. Mittag-Leffler gave a lecture on the arithmetic representation of analytic functions of a complex variable, and Prof. Forsyth lectured on the present condition of partial differential equations of the second order as regards formal integration.

The sectional meetings commenced on Tuesday morning, April 7, the sections being as follows:—i., analysis; ii., geometry; iii.*a*, dynamics and mathematical physics; iii.*b*, statistical and practical applications; iv., philosophy, history, and teaching of mathematics.

In the section of analysis, Prof. Marcolongo directed attention to the lamentable death on March 30 of Dr. Laura Pisati, who was at that time preparing her paper for the congress entitled "An Essay on a Synthetic Theory of Functions of a Complex Variable." From a long list of subsequent papers the following may be selected:—Jordan, solution of the sextic; Borel, theory of groups; Frizel, power of continuum; Young, applications of semi-continuous functions; Schlesinger, parametric problems in the theory of linear differential equations; Rémoundos, zeros of integrals of a class of differential equations; Volterra, method of images in the hyperbolic type; E. G. Moore, a form of general analysis; Fredholm, Fourier's integrals and theory of linear integral equations; Adhémar, equations of Fredholm and Volterra; Orlando, resolution of integral equations; Stéphanos, extension of invariant and covariant theory of binary forms.

In the geometry section, we note Andrade, theorem of Ampere-Stockes and Euclid's postulate; Bagnera, algebraic equations resolvable by meromorphic functions which are quadruply periodic in two parameters; Severi, certain results in algebraic geometry with special reference to the irregularities of a linear system; Bianchi, Darboux's transformation of surfaces of minimal area; Brouwer, a theory of groups independent of the axioms of Sophus Lie.

In section iii.*a*, Sir G. H. Darwin gave a communication on the rigidity of the earth, illustrated by diagrams showing the displacement of the vertical when the moon has a high north or south declination. It was estimated that the earth's surface rose and fell 17 cm. with the tides, and 20 cm. with variations of barometric pressure. Among other papers we notice Lauricella, certain extensions of the equation of elasticity; Lamb, a theoretical confirmation of the engineers' approximate treatment of bending of beams; E. E. Levi, discussion of certain elastic deformations which satisfy Weingastein's but not Volterra's condition; A. Korn, an attempt to build up a theory of pulsating spheres capable of accounting for electrical as well as gravitational phenomena; Levi Civita, retarded potentials; Garbasso, white light; Greenhill, geometry of gyroscopic motion, descriptive of a method of drawing families of curves hodographic to the Poinsot herpolhode; Sommerfeld, an attempt to account for turbulent motion of viscous liquids; Genese, reciprocal polars applied to statics; Kolosoff, elastic problems in two dimensions treated by complex variables.

Section iii.*b* met on three days only, the first two being devoted to statistical problems, with especial reference to life assurance. An address was given by the chairman, Signor Guido Toja, on the relations between mathematics and actuarial science, and the papers included Dawson, on necessary cautions in dealing with actuarial problems; Borel, application of probability to biology; Castelli, the teaching of actuarial science; Poussin and Elderton, papers of a graphical character; March, population statistics. The third sitting was devoted to the mathematics of engineering and building, a subject introduced by Prof. L. Luiggi. Papers were read by Prof. D'Ocagne, representing the French Office of Works, on the calculus in engineering, and the approximate rectification of circular arcs; by Swain, on teaching of mathematics for engineers; by Canevazzi, and finally by Claxton Fidler, on the theory of construction. The last-named communication derives considerable importance from the reference to the comparatively recent bridge disaster in America, which a mathematical investigation proved to have originated through one of the stays having had to play the part of a strut during the process of construction, thereby causing buckling, which would not have occurred in the completed structure.

The fourth section was devoted on the Tuesday morning mainly to philosophical aspects of mathematics, the subject being introduced by Prof. Federigo Enriques. A discussion between Profs. Itelson and Pastor was a noticeable feature of the proceedings. On the Wednesday and Saturday the discussions were mostly historical. Prof. Krazer directed attention to the publication of Euler's works, in accordance with a wish expressed at the previous congress, and proposed a vote of congratulation to the Swiss Society of Naturalists, which had undertaken the initiative in this task. It was further proposed to invite the Association of Academies, and the Academies of Berlin and St. Petersburg in particular, to assist in preparing the volumes. A proposal was made by Prof. Amodeo in favour of the publication of the collected works of Bonaventura Cavalieri. Thursday and Friday were devoted to the teaching of mathematics. A number of reports had been invited as to the position of mathematical teaching in the schools of various countries. Germany was represented by Gutzmer, France by Borel, Great Britain by Godfrey (whose paper was summarised by Vailati, and discussed by Gibson), the United States by D. T. Smith, Austria by Suppantschitsk, Hungary by Beke, Italy by Vailati and Conti, Switzerland by Fehr, Greece by Stéphanos. Prof. Archenhold proposed that a standing committee should be formed for the study of questions regarding the teaching of mathematics in secondary schools, this motion being carried in the section. Prof. Loria presented the first copy of the fourth volume of Moritz Cantor's "Vorlesungen über Geschichte der Matematik," and a volume containing the report of the educational committee of the German Association of Naturalists and Physicians was presented by Prof. Gutzmer.

The sectional meetings have, as a rule, lasted only about a couple of hours, leaving plenty of time for exchange of ideas between individual congressists outside the formal meetings.

The discourses, occupying a little under an hour each at the general meetings, have been another important feature of the congress. We have referred to the first three of these discourses; the remainder were as follows:—Darboux, methods and problems of infinitesimal geometry; von Dick, the Mathematical Encyclopædia; Newcomb, the theory of the lunar motion, its history and present state; Lorentz, partition of energy between matter and ether; Poincaré, an address read by Prof. Darboux on the future of mathematics; Picard, analysis in relation to mathematical physics; G. Veronese, non-archimedean geometry. A lantern lecture was given by Prof. Störmer on the trajectories of electrified corpuscles in the field of a magnetic molecule, with applications to the Aurora Borealis.

On the Wednesday evening a conversazione was given by the Municipality of Rome in the museum of the Capitol, which was brilliantly illuminated for the occasion; the reception commenced at 10 p.m., and lasted until the early hours of the next morning. On the Thursday the congress was entertained to a sumptuous tea, by invitation of the Minister of Public Instruction, at the Stadium discovered in 1893, on the Palatine Hill. The old mausoleum of Augustus has within the last two months been transformed into a concert hall, the stalls in which alone contained ample accommodation for the whole of the congressists. Here, on the Thursday evening, we listened to an orchestral concert conducted by Signor Luigi Mancinelli. The programme would be generally described as modern music; most of it was certainly very "modern."

A fitting termination to the work of the congress was afforded by a splendid open-air banquet at Tivoli, given in the grounds of the Hotel des Cascades on the Sunday, the morning being spent, so far as time allowed, in exploring Hadrian's Villa, where the *Anemone apennina* and other spring flowers were in full bloom, while a hurried visit to the cascades, temple of Serapis, and pretty gardens of the Villa d'Este, sometime known as the Villa Hohenlohe, occupied the too short interval after luncheon until the "steam rumbler" whirled us back to Rome, where we parted, hoping to meet in Cambridge in 1912.

In the official list of congressists we note about twenty-two English names, one with a German address and another from Egypt. That Great Britain should only be represented by four per cent. of the total number of congressists affords abundant evidence of the position of isolation into which our nation has drifted in its neglect of higher mathematics. There were many proofs that the Italian as well as the German mathematicians present constituted a powerful and influential body, and the presence of the King at the inaugural meeting—an honour rarely conferred on such occasions—together with the brilliancy of the receptions, afforded evidence of the esteem in which Italy holds the mathematical professors of her universities.

The French Government was represented officially by six delegates, besides special representatives of its Office of Works and statistical service. The Governments of Hungary and Roumania sent delegates, as did also many Continental actuarial societies and insurance companies. It is greatly to be hoped that the decision to hold the next congress in Cambridge may be the means of awakening our country to the great disabilities under which English mathematicians labour, in regard to higher study and research, in comparison with the mathematicians of other nations. If any good is to be done, the Cambridge congress must consist of something more than a mere display of hospitality towards foreign mathematicians. A determined effort must be made to work up a large English contingent to meet and exchange ideas with the congressists of other countries. A strong feeling has been expressed against the English practice at such occasions of officially providing private hospitality for some members and not for others, and it has been felt that the success of these foreign gatherings is largely due to the absence of any organised system of limited hospitality. Such a system necessarily divides the members into two parties, and raises up a barrier to free intercourse between them.

The invitation to Cambridge was proposed by Prof. Forsyth, who represented the Cambridge Philosophical Society. It was seconded by Prof. Blaserna, president of the present congress, and carried enthusiastically. For the congress of 1916, Stockholm has been proposed.

Before concluding, mention should be made of the special privileges offered by the Government and Municipality in throwing open all their museums and excavations to the congressists; the important concessions made by the Italian State Railways; and, last but not least, the unfailing courtesy of the local committee, under the secretaryship of Prof. G. Castelnuovo, through whose exertions everything passed off with the greatest success.

G. H. BRYAN.

JUBILEE OF THE CALCUTTA UNIVERSITY.

VERY few institutions have had such a remarkable influence on the history of any country as has been the case with the University of Calcutta, which celebrated its jubilee on March 14. To put the case on the lowest ground of mere numbers, while in the first year of its existence less than fifty students appeared at all its examinations from the matriculation upwards, during the last few years about 7000 students have appeared annually for its matriculation examination alone, while also in this its jubilee year no fewer than 855 students have taken their degrees in such subjects as arts, science, medicine, law and engineering.

Educational effort on Western lines has naturally been of comparatively recent development in India. For many years after the East India Company had taken over the administration of the territories which had been acquired in India, no attempt was made to establish any regular system of education, and, indeed, no pains seem to have been taken even to foster the indigenous systems which had been in existence throughout the country for many centuries. Later on spasmodic efforts were, however, made to try to prevent the higher forms of oriental learning from falling into decay by the establishment of the Calcutta Madrasah in 1782, intended for Mohammedans and for the study of Arabic and Persian, while a college for Hindus was started nine years later, the aim of which was to foster the study of Sanskrit and Sanskritic languages.

The general neglect of education by the administration continued up to about 1813, from which time public funds appear to have been set apart systematically for the furtherance of education. Up till about 1835 education was conducted largely by oriental methods and in oriental subjects, and the authorities were bent upon the improvement of education by the encouragement of those learned in Sanskrit and Arabic. At that time Lord Macaulay wrote a minute, which has since become historical, advocating the introduction of Western education into India, and the teaching of all the higher subjects through the medium of English. From 1835 to 1854 there was much controversy as to which of these two